System Architectural Features and Frequency Reuse (Continued)

- Diplexerless duplex and combinerless multichannel will support adaptive and dynamic information transfer rate on demand

- Linear architectures mandate deployment of robust broadband adaptive phase and amplitude channel equalization techniques for single site systems and multi-site quasi and fully synchronous systems for voice, data, and video

- Reuse is a complex technical issue that is IMPLEMENTATION specific

- If reuse is critical, architecture must be optimized for reuse

Spectrum Use Efficiency

- Spectrum efficiency does NOT mandate microcell architectures either in private or public carrier systems
- Balance between infrastructure cost and technology cost is necessary
- Multiple technology solutions are likely
  - Very high power large service radii very narrowband FDMA
  - Microcell CDMA
- Spectrally efficient solutions will be found in a variety of architectures
  - Broadband covert waveform overlay
  - Narrowband FDMA
  - Multi-slot TDMA

Spectrum Use Efficiency
(Continued)

- Developments in hybrid linear architectures will facilitate deployment of systems making use of frequency division multiplexing, frequency hopping, time division multiplexing, and CDMA

- 2.5 kHz FDMA channelization at bandwidth efficiencies of 7 b/s/Hz, supporting information transfer rates of up to 17.5 kb/s without guardband

- Linear TDMA providing multi-slot TDMA systems (10 slots in 25 kHz channel) affording bandwidth efficiencies comparable to 2.5 kHz channelized FDMA

Other Advanced Digital Wireless Technology Considerations
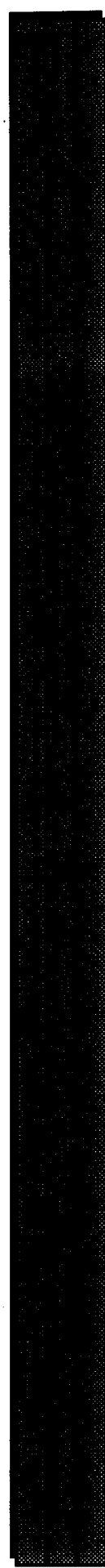
System Modeling, Simulation, and Performance Validation

- Enhance TIA TR8 WG8.8 Technology Compatibility Committee Efforts Major breakthrough in Modeling, Simulation, and Performance Validation
- Unified standard model for design, spectrum management, and empirical performance verification of any wireless system
- Initially based upon proven empirical propagation model with statistical patches
- Addresses analog and digital system usages
- Addresses 2-D and 3-D propagation modalities
- Ultimately will adopt a universally applicable deterministic 2-D and 3-D model such as the Anderson 2-D and 3-D
- Ultimately will support wideband system attributes
- Increased terrain, land use/land clutter database resolution will improve accuracy

Common Transmission Protocols

- Integrated packetized and switched data and provide hooks into the public switched telephone network in a ubiquitous fashion

Multimode/Multiband Subscriber Equipment

- Linear multimode/multiband architecture

- High power subscriber modes will be applicable in the rural and transitional suburban areas

- Low power broadband systems will likely predominate in urban areas

Covert Communications Support

- Broadband covert waveform techniques such as PN-DSSS, frequency hopping (FH), and hybrids thereof will permit universal overlay of existing and future narrowband and broadband signals for specialized applications

- Dynamically allocated PN-CDMA spread bandwidths ranging from 20-500 MHz

- FHSS systems operating over a 100 MHz bandwidth at hop rates of 100,000 hops/second

- Information transfer rates supported by these covert broadband systems will range from the low 10 kb/s to low 100's kb/s

Public Carrier Conveyances

- Mobile and portable telephone and multimedia service via linear system architectures based upon cellular/microcell and picocell configurations

- Effective cell radii will range from.01 km to 10 km and will be very physical plant investment intensive

Suggested Measure of Spectral Efficiency in Land Mobile Wireless Systems

- Voice channel equivalent Erlangs per MHz bandwidth per square kilometer

or

- $E_{vce}/MHz/Km^2$

- Similar to that proposed by Hatfield and MacDonald, but normalizes load to a Voice Channel Equivalent Baseline

Advanced Digital Wireless Technology
Features and Attributes

- Advanced systems should be evaluated in terms of the following features and attributes
  - Teleservices
    - » Unenciphered and/or enciphered digital speech
    - » Individual call (point-to-point)
    - » Group call (point-to-multipoint)
    - » Broadcast call (point-to-multipoint one way)
  - Video Services
    - » Unenciphered and/or enciphered slow motion video
    - » Unenciphered and/or enciphered full motion video
    - » Individual call (point-to-point)
    - » Group call (point-to-multipoint)
    - » Broadcast call (point-to-multipoint one way)

Advanced Digital Wireless Technology
Features and Attributes
(Continued)

- Bearer Services
    - » Unenciphered and/or enciphered digital data
        - Circuit Switched Unreliable Data
        - Circuit Switched Reliable Data
        - Packet Switched Unconfirmed Data Delivery
        - Packet Switched Confirmed Data Delivery
        - Circuit Switched Data Network Access
        - Packet Switched Data Network Access
        - Preprogrammed Data Message

Advanced Digital Wireless Technology
Features and Attributes
(Continued)

- Supplementary Services
  - » Encipherment
  - » Priority Call
  - » Pre-emptive Priority Call
  - » Call Interrupt
  - » Voice Telephone Interconnect
  - » Discrete Listening
  - » Ambiance Listening
  - » Talking Party Identification
  - » Call Alerting